CLAIM AMENDMENTS

1   1.   (Currently amended) A method of determining a placement of services of a
2   distributed application onto nodes of a distributed resource infrastructure
3   comprising the steps of:
4   a.   establishing a placement indicator for a specific service;
5   b.   forming communication constraints between node pairs which ensure that
6   a sum of transport demands between a particular node pair does not exceed a
7   transport capacity between the particular node pair, each term of the sum
8   comprising a product of a first placement variable, a second placement
9   variable, and the transport demand between the services associated with the
10   first and second placement variables;
11   c.   forming an objective; and
12   d.   employing a local search solution to solve an integer program comprising
13   the placement indicator, the communication constraints, and the objective to
14   determine the placement of the services onto the nodes.

1   2.   (Original)   The method of claim 1 wherein the placement indicator
2   comprises a pre-defined placement.

1   3.   (Original)   The method of claim 2 wherein the pre-defined placement
2   comprises placing the specific service onto a specific node.

1   4.   (Original)   The method of claim 2 wherein the pre-defined placement
2   comprises not placing the specific service onto a specific node.

1   5.   (Original)   The method of claim 1 wherein the placement indicator
2   comprises a neutral indication of whether the specific service is to be placed onto
3   a specific node.

1   6.   (Currently amended) A method of determining a placement of services of a
2   distributed application onto nodes of a distributed resource infrastructure
3   comprising the steps of:
4   a.   establishing an application model of the services comprising transport

5 demands between the services;

6 b. establishing an infrastructure model of the nodes comprising transport

7 capacities between the nodes;

8 c. establishing a placement model comprising placement indicators for the

9 services;

10 d. forming an integer program that comprises:

11   i. a set of placement variables for a combination of the services and the

12   nodes, each of the placement variables indicating whether a particular

13   service is located on a particular node;

14   ii. communication constraints between node pairs which ensure that a

15   sum of the transport demands between a particular node pair does not

16   exceed the transport capacity between the particular node pair, each term

17   of the sum comprising a product of a first placement variable, a second

18   placement variable, and the transport demand between the services

19   associated with the first and second placement variables;

20   iii. placement constraints for the services which ensure that the services

21   are placed onto the nodes in accord with the placement indicators; and

22   iv. an objective; and

23 e. employing a local search solution to solve the integer program which

24 determines the placement of the services onto the nodes.

1 7. (Original) The method of claim 6 wherein a particular placement indicator

2 comprises an indication that a specific service is to be placed onto a specific node.

1 8. (Original) The method of claim 6 wherein a particular placement indicator

2 comprises an indication that a specific service is not to be placed onto a specific

3 node.

1 9. (Original) The method of claim 6 wherein a particular placement indicator

2 comprises a neutral indication of whether a specific service is to be placed onto a

3 specific node.

1 10. (Original) The method of claim 9 wherein a default for the placement

2 indicators comprises the neutral indication.

1 11. (Currently amended) A method of determining a placement of services of a

2 distributed application onto nodes of a distributed resource infrastructure

3 comprising the steps of:

4 a. establishing an application model of the services that comprises processing

5 demands for the services, storage demands for the services, and transport

6 demands between the services;

7 b. establishing an infrastructure model of the nodes that comprises processing

8 capacities for the nodes, storage capacities for the nodes, and transport

9 capacities between the nodes;

10 c. establishing a placement model comprising placement indicators for the

11 services;

12 d. forming an integer program that comprises:

13 i. a set of placement variables for a combination of the services and the

14 nodes, each of the placement variables indicating whether a particular

15 service is located on a particular node;

16 ii. processing constraints which ensure that a sum of the processing

17 demands for each of the nodes does not exceed the processing capacity for

18 the node;

19 iii. storage constraints which ensure that a sum of the storage demands for

20 each of the nodes does not exceed the storage capacity for the node;

21 iv. first placement constraints which ensure that each of the services is

22 placed on one and only one node;

23 v. second placement constraints which ensure that the services are placed

24 onto the nodes in accord with the placement indicators;

25 vi. communication constraints between node pairs which ensure that a

26 sum of the transport demands between a particular node pair does not

27 exceed the transport capacity between the particular node pair, each term

28 of the sum comprising a product of a first placement variable, a second

29 placement variable, and the transport demand between the services

30 associated with the first and second placement variables; and

31 vii. an objective of minimizing communication traffic between the nodes

32 and balancing processing loads on the nodes; and

33 e. employing a local search solution to solve the integer program which

34   determines the placement of the services onto the nodes.

1   12.   (Currently amended) A computer readable memory comprising computer

2   code for directing a computer to make a determination of a placement of services

3   of a distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps

5   of:

6   a.   establishing a placement indicator for a specific service;

7   b.   forming communication constraints between node pairs which ensure that

8   a sum of transport demands between a particular node pair does not exceed a

9   transport capacity between the particular node pair, each term of the sum

10   comprising a product of a first placement variable, a second placement

11   variable, and the transport demand between the services associated with the

12   first and second placement variables;

13   c.   forming an objective; and

14   d.   employing a local search solution to solve an integer program comprising

15   the placement indicator, the communication constraints, and the objective to

16   determine the placement of the services onto the nodes.

1   13.   (Original)   The computer readable memory of claim 12 wherein the

2   placement indicator comprises a pre-defined placement.

1   14.   (Original)   The computer readable memory of claim 13 wherein the pre-

2   defined placement comprises placing the specific service onto a specific node.

1   15.   (Original)   The computer readable memory of claim 13 wherein the pre-

2   defined placement comprises not placing the specific service onto a specific node.

1   16.   (Original)   The computer readable memory of claim 12 wherein the

2   placement indicator comprises a neutral indication of whether the specific service

3   is to be placed onto a specific node.

1   17.   (Currently amended) A computer readable memory comprising computer

2   code for directing a computer to make a determination of a placement of services

3   of a distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps

5   of:

6   a.   establishing an application model of the services comprising transport

7   demands between the services;

8   b.   establishing an infrastructure model of the nodes comprising transport

9   capacities between the nodes;

10   c.   establishing a placement model comprising placement indicators for the

11   services;

12   d.   forming an integer program that comprises:

13   i.   a set of placement variables for a combination of the services and the

14   nodes, each of the placement variables indicating whether a particular

15   service is located on a particular node;

16   ii.   communication constraints between node pairs which ensure that a

17   sum of the transport demands between a particular node pair does not

18   exceed the transport capacity between the particular node pair, each term

19   of the sum comprising a product of a first placement variable, a second

20   placement variable, and the transport demand between the services

21   associated with the first and second placement variables;

22   iii.   placement constraints for the services which ensure that the services

23   are placed onto the nodes in accord with the placement indicators; and

24   iv.   an objective; and

25   e.   employing a local search solution to solve the integer program which

26   determines the placement of the services onto the nodes.

1   18.   (Original)   The computer readable memory of claim 17 wherein a

2   particular placement indicator comprises an indication that a specific service is to

3   be placed onto a specific node.

1   19.   (Original)   The computer readable memory of claim 17 wherein a

2   particular placement indicator comprises an indication that a specific service is not

3   to be placed onto a specific node.

1   20.   (Original)   The computer readable memory of claim 17 wherein a

2   particular placement indicator comprises a neutral indication of whether a specific

3   service is to be placed onto a specific node.

1   21.   (Original)   The computer readable memory of claim 20 wherein a default

2   for the placement indicators comprises the neutral indication.

1   22.   (Original)   The computer readable memory of claim 20 wherein a matrix is

2   specified which expresses constraints or preferences for identifying a placement of

3   services onto nodes.

1   23.   (Currently amended) A computer readable memory comprising computer

2   code for directing a computer to make a determination of a placement of services of a

3   distributed application onto nodes of a distributed resource infrastructure, the

4   determination of the placement of the services onto the nodes comprising the steps of:

5   a.   establishing an application model of the services that comprises processing

6   demands for the services, storage demands for the services, and transport

7   demands between the services;

8   b.   establishing an infrastructure model of the nodes that comprises processing

9   capacities for the nodes, storage capacities for the nodes, and transport

10   capacities between the nodes;

11   c.   establishing a placement model comprising placement indicators for the

12   services;

13   d.   forming an integer program that comprises:

14   i.   a set of placement variables for a combination of the services and the

15   nodes, each of the placement variables indicating whether a particular

16   service is located on a particular node;

17   ii.   processing constraints which ensure that a sum of the processing

18   demands for each of the nodes does not exceed the processing capacity for

19   the node;

20   iii.   storage constraints which ensure that a sum of the storage demands for

21   each of the nodes does not exceed the storage capacity for the node;

22   iv.   first placement constraints which ensure that each of the services is

23   placed on one and only one node;

24   v.   second placement constraints which ensure that the services are placed

25		onto the nodes in accord with the placement indicators;
26	vi.	communication constraints between node pairs which ensure that a
27		sum of the transport demands between a particular node pair does not
28		exceed the transport capacity between the particular node pair, each term
29		of the sum comprising a product of a first placement variable, a second
30		placement variable, and the transport demand between the services
31		associated with the first and second placement variables; and
32	vii.	an objective of minimizing communication traffic between the nodes
33		and balancing processing loads on the nodes; and
34	e.	employing a local search solution to solve the integer program which
35		determines the placement of the services onto the nodes.